






## ORIGINAL ARTICLE

# Suicide Crisis Inventory-2: factor structure, internal consistency, and validity in a Brazilian sample

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**Objective:** To evaluate the factor structure, reliability, and validity of the Brazilian version of the Suicide Crisis Inventory-2 (SCI-2) among Brazilian adults.

**Methods:** The SCI-2 was cross-culturally adapted into Portuguese and administered to 2,265 Brazilian participants. Confirmatory factor analysis (CFA) was used to assess factor structure, internal consistency, convergent validity, and criterion validity by using measures such as suicidal narratives, stressful life events, suicidal ideation, and suicide attempts.

**Results:** The revised one-factor model of the SCI-2 demonstrated an adequate, although not optimal, model fit ( $\chi^2_{[1539]} = 31,442.79$ ,  $p < 0.001$ , comparative fit index [CFI] = 0.99, Tucker-Lewis index [TLI] = 0.99, root mean square error of approximation [RMSEA] = 0.09, standardized root mean residual [SRMR] = 0.05). The revised five-factor model, on the other hand, demonstrated good fit ( $\chi^2_{[1529]} = 14,174.86$ ,  $p < 0.001$ , CFI = 1.00, TLI = 1.00, RMSEA = 0.06, SRMR = 0.04). Comparison of these two models indicated that the five-factor model had a better fit than the one-factor model. Both the total and subscale scores of the SCI-2 showed strong internal consistency and good convergent and criterion validity in relation to stressful life events, suicidal narratives (excluding the goal disengagement subscale), suicidal ideation, and suicide attempts.

**Conclusion:** Our findings suggest that the Brazilian version of the SCI-2 is a valid tool for assessing symptoms of suicidal crisis syndrome.

**Keywords:** Suicide crisis syndrome; Suicide Crisis Inventory-2; suicide; suicidal ideation; risk assessment

## Introduction

Suicide is a major public health problem worldwide. In Brazil, the suicide rate has increased from 5.24 to 6.65 per 100,000 people in the last decade (2010-2019).<sup>1,2</sup> During this period, 112,230 people died by suicide, which represents a 43% increase in the annual number of deaths.<sup>3</sup> Therefore, finding ways to reduce suicide rates and identify individuals at increased risk is critical to public health.<sup>4</sup>

Suicidal ideation is the third most influential predictor of eventual death by suicide.<sup>5,6</sup> However, most individuals who have attempted suicide or are at increased risk do not express suicidal ideation prior to an attempt, rendering suicidal ideation an unreliable indicator.<sup>7-9</sup> This reluctance to express suicidal ideation may be due to a number of

factors, including fear of hospitalization, stigma from health care professionals, embarrassment, confusion, and shame.<sup>10-12</sup> Consequently, suicide-specific conditions (e.g., suicide crisis syndrome [SCS]) that do not depend on the identification of suicidal ideation could improve the clinical identification of individuals at risk, increase patient safety, and reduce medical malpractice.<sup>4,13,14</sup> Notably, the SCS is a promising approach to suicide risk assessment that does not explicitly consider suicidal ideation.<sup>15,16</sup>

Recent studies have introduced the SCS as a mental state associated with imminent suicidal behavior.<sup>15,17,18</sup> The SCS was developed based on empirical predictors of imminent risk for suicidal behavior and includes cognitive and affective features that precede suicide attempts.<sup>19,20</sup> This mental state is marked by a feeling of frantic

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hopelessness or entrapment accompanied by affective disturbances, loss of cognitive control, hyperarousal, and social withdrawal.<sup>14,20-22</sup> In particular, the most recent the SCS formulation serves as the basis for a proposed suicide-specific diagnosis in the DSM-5-TR.<sup>21,23</sup>

The Suicide Crisis Inventory (SCI) is an instrument designed to assess the severity of SCS-related symptoms.<sup>20</sup> Previous studies have shown that SCI scores can predict suicidal behavior in high-risk psychiatric inpatients in the initial weeks following hospital discharge.<sup>20</sup> In addition, according to machine learning approaches, the SCI was predictive of short-term suicidal behavior.<sup>24</sup> Recent revisions have led to the development of the Suicide Crisis Inventory-2 (SCI-2).<sup>23</sup> These studies should be replicated to determine the generalizability of the SCI-2 to different linguistic and cultural settings and to assess its construct validity with respect to the SCS criteria as a proposed suicide-specific diagnosis.<sup>20,23</sup> Although the SCI-2 has been evaluated in several countries, including India,<sup>25</sup> Russia,<sup>26</sup> South Korea,<sup>27</sup> and Taiwan,<sup>28</sup> it has not been evaluated in the Brazilian population.

Therefore, the present study aimed to investigate whether the psychometric properties of the Brazilian version of the SCI-2 are consistent with those of the original English version. Specifically, we focused on examining the factor structure, internal consistency, and convergent validity of the SCI-2 in a Brazilian sample. We hypothesized that i) the SCI-2 would fit the five-factor structure as well as the one-factor structure achieved by the original SCI<sup>23,29</sup> and ii) the SCI-2 would demonstrate good internal consistency as well as strong convergent and criterion validity, consistent with previous findings.<sup>23</sup>

## Methods

### Sample and procedure

Data were obtained from the Brazilian sample of the International Suicide Prevention Assessment Research for COVID-19 study.<sup>30</sup> A total of 2,265 Brazilians (70.7% female) aged 18 to 70 years (mean age = 31.27 years [SD = 10.90]) from all five geographical regions of Brazil (North, Northeast, Midwest, Southeast, South) were recruited from November 2020 to October 2021 via advertisements on social media platforms (Table 1). Participants completed an online survey using Qualtrics, a web interface that allows for secure remote data collection by distributing anonymous secure links to the study protocol. Prior to the beginning of the research, all survey batteries (i.e., the Abbreviated Suicidal Narrative Inventory [SNI-38], the SCI-2, and the Stressful Life Events Questionnaire [SLEQ]) were translated and cross-culturally adapted from English to Portuguese as described below. All participants were fluent in Brazilian Portuguese and were able to understand and digitally sign the informed consent form. Upon completion of the informed consent process, participants completed a battery of self-report measures included in the study.

**Table 1** Sample sociodemographic characteristics

Characteristics	
Gender	
Cisgender man	637 (28.1)
Cisgender woman	1,601 (70.7)
Transgender man	1 (0.0)
Transgender woman	2 (0.1)
Nonbinary	11 (0.5)
Not sure	6 (0.3)
Decline to state	7 (0.3)
Age (M = 31.27, SD = 10.90, range = 18-70)	
Marital status	
Single/never married	882 (38.9)
Married	536 (23.7)
Separated	18 (0.8)
Divorced	59 (2.6)
Widowed	8 (0.4)
In a relationship	464 (20.5)
Cohabiting	298 (13.2)
Education	
High school/equivalent	106 (4.7)
2-year college (diploma)	16 (0.7)
Some college	783 (34.6)
4-year college (bachelor's degree)	662 (29.2)
Master's degree	467 (20.6)
Doctoral degree	225 (9.9)
Did not complete high school	6 (0.3)
Lifetime suicidal ideation	1,281 (57.8)
Past-month suicidal ideation	597 (27.0)
Lifetime suicide attempt	242 (12.3)

Data are presented as n (%).

### Process of cross-cultural adaptation

The cross-cultural adaptation process involved two independent initial translations, synthesis of these translations, back-translation, review by an expert committee, and testing of the prefinal version of the SCI-2.<sup>31</sup> First, two forward translations (T1, T2) from English to Portuguese were made by two bilingual translators, both native Portuguese speakers of different backgrounds. Subsequently, these translators, along with a new observer, synthesized the translated versions (T1 and T2) and compared discrepancies. Using the synthesized version (T1-2), a translator fluent in English, blinded to the original SCI-2 version, back-translated the questionnaire into English. The back-translation stage was performed to check if the translated version reflected the same content as the original version. Then, an expert committee of clinicians, health professionals, methodologists, and translators consolidated the prefinal version of the SCI-2, focusing on semantic, idiomatic, experiential, and conceptual cross-cultural equivalence rather than literal equivalence. For this stage, the committee used i) the original English version, ii) the back-translated version corrected by the author, and iii) all Portuguese versions to achieve equivalence. Upon approval of the back-translation by the original author, the translations were subjected to a small pilot test to assess their acceptability and comprehensibility. This final version was then used for

subsequent psychometric analyses and is available as Supplementary Material S1.

### Measures

#### Suicide Crisis Inventory-2 (SCI-2)

The SCI-2 is the revised version of the original 61-item self-report SCI<sup>23</sup> tailored to assess the presence of SCS-related symptoms. The SCI-2 consists of five subscales rated on a five-point Likert scale ranging from 0 (not at all true) to 4 (extremely true): i) entrapment (10 items); ii) affective disturbance (18 items); iii) loss of cognitive control (15 items); iv) hyperarousal (13 items); and v) social withdrawal (5 items). In this study, we used both the total and subscale scores of the SCI-2 to assess its internal consistency and convergent validity. Our results indicate that the SCI-2 has high internal consistency ( $\alpha = 0.99$ ), which is consistent with previous studies ( $\alpha = 0.97$ ).<sup>20,23</sup>

#### Abbreviated Suicidal Narrative Inventory (SNI-38)

The abbreviated 38-item version of the SNI-38 was derived from factor analysis of the original 132-item SNI by Cohen et al.<sup>32</sup> The SNI-38 was also tested by Menon et al.<sup>25</sup> (India), Chang et al.<sup>33</sup> (Taiwan), and Chistopolskaya et al.<sup>34</sup> (Russia). It comprises eight subscales: i) thwarted belongingness (5 items) ( $\alpha = 0.83$ ); ii) perceived burdensomeness (5 items) ( $\alpha = 0.93$ ); iii) fear of humiliation (5 items) ( $\alpha = 0.88$ ); iv) defeat (5 items) ( $\alpha = 0.93$ ); v) goal disengagement (3 items) ( $\alpha = 0.62$ ); vi) goal reengagement (5 items) ( $\alpha = 0.93$ ); vii) entrapment (5 items) ( $\alpha = 0.90$ ); and viii) perfectionism (5 items) ( $\alpha = 0.87$ ). Items on the scale are scored on a five-point Likert scale ranging from 0 (not at all true) to 4 (extremely true). Subscale scores of the SNI-38 were used to assess convergent validity with the SCI-2.

#### Stressful Life Events Questionnaire (SLEQ)

The SLEQ is a 22-item self-report questionnaire developed by Cohen et al.,<sup>35</sup> adapted from several older scales.<sup>36-39</sup> The questionnaire lists 22 recent life events that might have occurred within the past 3 months or the past week (nonoverlapping), excluding ongoing or chronic stressors. The SLEQ comprises five categories of stressful life events: i) harm to a close person or pet (3 items); ii) a relationship stressor (5 items); iii) a threat to self-role/identity (5 items); iv) a threat to self-personal safety (8 items); and v) other stressors (1 item). Based on previous studies, stressful life events occurring within the past week and past 3 months were included to test convergent validity with the SCI-2.<sup>40,41</sup>

#### Columbia-Suicide Severity Rating Scale

The Columbia-Suicide Severity Rating Scale (C-SSRS) is a semi-structured interview that measures the severity of suicidal behavior.<sup>42</sup> In the self-report screener version of the C-SSRS, individuals have to rate the severity of

suicidal ideation on a scale of 0 to 5 by using “yes” or “no,” ranging from thoughts of death, suicidal ideation, consideration of a method, suicidal intent, and suicidal ideation with a plan and intent to act on this plan. For descriptive statistics, individuals who scored nonzero on these measures are classified as having suicidal ideation. Suicide attempts were assessed with the items: “Have you ever attempted suicide/tried to kill yourself?” and “Have you attempted suicide/tried to kill yourself in the past month?,” which the participants answered with “yes” or “no.” To test for convergent validity with the SCI-2, we used the scores for total suicidal ideation intensity and suicide attempts.

### Data analysis

First, the Kaiser-Meyer-Olkin (KMO) test and Bartlett’s test of sphericity were used to establish the suitability of the data for factor analysis.<sup>43,44</sup> Confirmatory factor analyses (CFAs) were then conducted to test the proposed one- and five-factor structures of the Brazilian version of the SCI-2 and to examine whether they were consistent with the original English version of the SCI-2. In the one-factor model, all items were set to load on a single factor; whereas in the five-factor model, items were set to load on their respective subscale domains: i) entrapment, ii) affective disturbances, iii) loss of cognitive control, iv) hyperarousal, and v) social withdrawal. Due to the ordinal nature of the items, the diagonally weighted least squares (WLSs) estimation was used. Model fit was evaluated using established guidelines,<sup>45,46</sup> including the chi-square statistic ( $\chi^2$ ), comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean residual (SRMR). Specifically, good model fit was indicated by a nonsignificant  $\chi^2$  statistic,  $CFI \geq 0.95$ ,  $TLI \geq 0.95$ ,  $RMSEA \leq 0.08$ , and  $SRMR \leq 0.08$ . Comparison between the one-factor and five-factor models was conducted using the robust chi-square difference test. The reliability of the resulting scales was assessed using Cronbach’s alpha. Finally, convergent and criterion validity with other related scales were assessed by calculating bivariate correlations between the total and subscale scores of the SCI-2 and all other measures. Missing data were handled by listwise deletion, and all analyses were conducted on R using the *lavaan*,<sup>47</sup> *semTools*,<sup>48</sup> and *psych*<sup>49</sup> packages.

### Ethics statement

This study was approved by the research ethics committee of Universidade do Extremo Sul Catarinense under approval number 4,275,326 (CAAE no. 37216620.6.0000.0119).

## Results

### Examination of factor structure

Both the KMO statistic (0.99) and Bartlett’s test of sphericity ( $\chi^2_{[1830]} = 120,297.04$ ,  $p < 0.001$ ) indicated that the

data had substantial and significant correlations to be suitable for factor analysis.

#### One-factor model

The initial one-factor CFA of the Brazilian version of the SCI-2 resulted in a poor-to-adequate model fit ( $\chi^2_{[1769]} = 41,101.16$ ,  $p < 0.001$ , CFI = 0.99, TLI = 0.99, RMSEA = 0.10, SRMR = 0.06). Examination of factor loadings revealed that all four items assessing cognitive rigidity did not load significantly on the factor as expected (i.e., one item loaded negatively [-0.49] and three items did not significantly load on the factor [-0.15 to 0.05]). Thus, a revised one-factor CFA was conducted in which these four items were removed, showing an improved, though still not optimal, model fit ( $\chi^2_{[1539]} = 31,442.79$ ,  $p < 0.001$ , CFI = 0.99, TLI = 0.99, RMSEA = 0.09, SRMR = 0.05). All these items significantly loaded ( $\geq 0.35$ ) on the latent factor. Standardized factor loadings are presented in Table 2.

#### Five-factor model

Results of the initial five-factor CFA of the Brazilian version of the SCI-2 indicated a good model fit ( $\chi^2_{[1759]} = 23,717.62$ ,  $p < 0.001$ , CFI = 1.00, TLI = 0.99, RMSEA = 0.07, SRMR = 0.05). However, the four cognitive rigidity items again did not load on the loss of cognitive control factor in accordance with theoretical expectations (i.e., one item loaded negatively [-0.51] and three items did not load significantly on the factor [-0.16 to 0.06]). Therefore, a revised five-factor CFA was conducted in which these four items were excluded, resulting in an improved and good model fit ( $\chi^2_{[1529]} = 14,174.86$ ,  $p < 0.001$ , CFI = 1.00, TLI = 1.00, RMSEA = 0.06, SRMR = 0.04). In addition, all latent factors in the five-factor model were significantly associated with each other ( $p < 0.001$ ). Tables 2 and 3 present the standardized factor loadings and covariances among the latent factors, respectively.

Comparison of the one-factor and five-factor models indicated that the five-factor model exhibited superior model fit to the one-factor model ( $\Delta\chi^2_{10} = 17,267.93$ ,  $p < 0.001$ ). The results of the CFA are presented in Table 2.

#### *Convergent and criterion validity*

Table 4 presents descriptive statistics and internal consistencies of total and subscale scores of the SCI-2 and correlations between these scales and other relevant constructs. The internal consistencies of the total and subscale scores of the SCI-2 were high. The total and subscale scores of the SCI-2 were significantly and positively correlated with suicidal narratives, stressful life events in the past week and past 3 months, lifetime and past-month suicidal ideation, and lifetime suicide attempts. Most of effect sizes were moderate to large in strength ( $r = 0.21$  to  $0.78$ ). However, goal disengagement from the suicidal narrative showed a negative correlation with the total and subscale scores of the SCI-2.

Descriptive statistics of the total scores of SCI-2 and detailed correlation coefficients are presented in Table 4.

## Discussion

The present study aimed to evaluate the psychometric properties of the Brazilian version of the SCI-2. Validation analyses were performed on a Brazilian sample with diverse demographic and clinical characteristics, not necessarily psychiatric. The findings partially supported our initial hypothesis, suggesting that both the one-factor and five-factor structures would achieve a good model fit, similar to the original version. The results of the one-factor CFAs did not provide as good a model fit as previous research did<sup>23,29</sup>; however, the SCI-2 fit the five-factor structure, demonstrating a superior model fit compared to the one-factor model after adjustment for the loss of the cognitive control subscale. In addition, consistent with our second hypothesis, we observed strong internal consistency as well as good convergent and criterion validity with constructs related to suicidal narratives (i.e., thwarted belongingness, perceived burdensomeness, defeat, entrapment, humiliation, perfectionism, and goal reengagement), stressful life events, and current and lifetime suicidal ideation and suicide attempts.

The current study replicates the main findings of previous research examining factor structure, reliability, and convergent validity of the SCI-2.<sup>23,38</sup> However, it is important to note that the revised one-factor CFA did not achieve optimal model fit. This finding is inconsistent with the revised version of the SCI-2, in which the one-factor model achieved good fit.<sup>23,25,27</sup> The one-factor structure of the SCI-2 indicates that the SCS can be adopted as a unidimensional diagnosis assessable on a continuous scale composed of five distinct subsymptoms.<sup>20,50</sup> It is important to note that previous studies supporting a one-factor model also support the unidimensionality of the SCS structure, whereas our study does not support such a model. Notably, our findings were derived from a Brazilian community sample, which differs from the original version based on psychiatric patients, which could explain the discrepancy in the results.

Consistent with our findings, previous studies have demonstrated the superiority of the five-factor SCI-2 model over the one-factor model.<sup>23,25,50</sup> These findings provide support to the proposed SCS diagnostic criteria for SCS, which include entrapment/frantic hopelessness, affective disturbance, loss of cognitive control, hyperarousal, and social withdrawal.<sup>23,29</sup> These components are intended to encompass the full spectrum of mental, behavioral, and emotional states that precede short-term suicide attempts.<sup>14</sup> For an individual to have the SCS, criterion A and all four components of criterion B must be fully met to reliably predict short-term suicide attempts.<sup>18,50</sup> These diagnostic criteria for SCS were proposed based on the format of the DSM.<sup>18,50</sup> Thus, our findings demonstrate the validity and reliability of the Brazilian version of the SCI-2 five-factor model, suggesting its potential as a valuable clinical tool for assessing suicide risk.

**Table 2** Standardized factor loadings of all items

Factor/item	One-factor model	Five-factor model
<b>Entrapment</b>		
Item 2 - Did you feel there was no exit?	0.88	0.91
Item 4 - Did you feel yourself thinking that things would never change?	0.85	0.89
Item 15 - Did you feel trapped?	0.77	0.81
Item 19 - Did you feel that there were no good solutions to your problems?	0.87	0.91
Item 25 - Did you feel helpless to change?	0.84	0.88
Item 27 - Did you feel doomed?	0.84	0.87
Item 35 - Did you feel hopeless?	0.87	0.90
Item 39 - Did you feel that there was no way out?	0.91	0.94
Item 56 - Did you feel there is no escape?	0.89	0.92
Item 58 - Did you feel that the world was closing in on you?	0.86	0.90
<b>Affective disturbances</b>		
Item 1 - Did you feel a sense of inner pain that had to be stopped?	0.88	0.89
Item 3 (R) - Did you enjoy being with your family or close friends?	0.36	0.37
Item 6 - Did you feel suddenly frightened to such an extent that you developed physical symptoms or had a panic attack?	0.82	0.84
Item 8 - Did you feel any unusually intense or deep negative feelings or mood swings directed towards someone else?	0.75	0.76
Item 10 - Did you feel you had lost your interest in other people?	0.75	0.77
Item 12 - Did you feel blood rushing through your veins?	0.85	0.87
Item 13 - Did you feel nervousness or shakiness inside?	0.83	0.85
Item 18 - Did you become afraid that you would die?	0.55	0.56
Item 22 - Did you feel strange sensations in your body or on your skin?	0.78	0.79
Item 28 (R) - Did you find pleasure in your hobbies and pastimes?	0.42	0.43
Item 30 - Did you feel that ordinary things looked strange or distorted?	0.80	0.82
Item 38 - Did you feel dissatisfied or bored with everything?	0.80	0.82
Item 43 - Did you feel that the urge to escape the pain was very hard to control?	0.90	0.91
Item 44 - Did you have a sense of inner pain that was too much to bear?	0.85	0.86
Item 45 - Did you feel any unusually intense or deep negative feelings or mood swings directed towards yourself?	0.87	0.88
Item 46 - Did you feel relentless, agonizing emotional pain?	0.90	0.92
Item 50 - Did you feel unusual physical sensations that you have never felt before?	0.70	0.72
Item 54 - Did you feel that your emotional pain was unbearable?	0.92	0.93
<b>Loss of cognitive control</b>		
Item 5. Did you have a decreased ability to think, concentrate or make decisions, due to too many thoughts?	0.83	0.86
Item 11 - Did you feel bothered by thoughts that did not make sense?	0.84	0.86
Item 14 - Did you feel pressure in your head from thinking too much?	0.87	0.89
Item 17 - Did you feel that it was hard for you to stop worrying?	0.84	0.87
Item 26 - Did you want your troubling thoughts to go away but they wouldn't?	0.92	0.94
Item 33 - Did you feel that ideas kept turning over and over in your mind and they wouldn't go away?	0.89	0.92
Item 48 - Did you feel powerless to stop the thoughts that were upsetting you?	0.92	0.94
Item 51 - Did you feel your thoughts were racing?	0.86	0.89
Item 57 - Did you feel like you were getting a headache from too many thoughts in your head?	0.82	0.84
Item 59 - Did you feel that your head could explode from too many thoughts?	0.86	0.89
Item 61 - Did you have many thoughts in your head?	0.82	0.84
<b>Hyperarousal</b>		
Item 7 - Did you feel you were constantly watching for signs of trouble?	0.77	0.80
Item 16 - Did you feel you wanted to crawl out of your skin?	0.85	0.88
Item 20 - Did you feel that most people could not be trusted?	0.67	0.69
Item 21 - Did you wake up from sleep tired and not refreshed?	0.70	0.73
Item 29 - Did you have trouble falling asleep because you were having thoughts that you could not control?	0.77	0.80
Item 32 - Did you feel that if you didn't stay alert and watchful, something bad would happen?	0.66	0.69
Item 36 - Did you feel a lot of emotional turmoil in your gut?	0.70	0.73
Item 41 - Did you have temper outbursts that you could not control?	0.77	0.80
Item 42 - Did you have temper outbursts that you could not control?	0.64	0.67
Item 47 - Did you feel tensed or keyed up?	0.79	0.83
Item 49 - Did you feel so restless you could not sit still?	0.68	0.71
Item 53 - Did you feel easily annoyed or irritated?	0.80	0.83
Item 60 - Did you feel so stirred up inside you wanted to scream?	0.82	0.86

Continued on next page

**Table 2** (continued)

Factor/item	One-factor model	Five-factor model
Social withdrawal		
Item 23 - Did you feel isolated from others?	0.75	0.91
Item 31 - Did you feel you did not open up to members of your family/friends?	0.73	0.87
Item 40 - Did you push away people who care about you?	0.80	0.91
Item 52 - Did you interact less with people who care about you?	0.74	0.88
Item 55 - Did you evade communications with people who care about you?	0.81	0.92

Four items from the loss of cognitive control subscale were excluded due to inconsistent loading with theory: Item 9 - Did you feel your views were very consistent over time? Item 24 (R) - Did you often change your mind? Item 34 (R) - Did you feel you could change your mind once you've come to a conclusion? Item 37 (R) - Did you feel you could easily change your mind over things that bother you?

**Table 3** Covariances between all latent factors

Variable	2	3	4	5
1. Entrapment	0.82*	0.69*	0.69*	0.61*
2. Affective disturbance	-	0.79*	0.81*	0.70*
3. Loss of cognitive control		-	0.69*	0.57*
4. Hyperarousal			-	0.62*
5. Social withdrawal				-

\*  $p < 0.001$ .

**Table 4** Correlations between the total and subscale scores of the SCI-2 and other relevant constructs

	SCI-2 total	SCI-2 entrapment	SCI-2 affective disturbance	SCI-2 loss of cognitive control	SCI-2 hyperarousal	SCI-2 social withdrawal
SNI TB	0.41	0.40	0.42	0.33	0.36	0.45
SNI PB	0.60	0.60	0.59	0.51	0.55	0.50
SNI defeat	0.75	0.76	0.72	0.67	0.68	0.63
SNI entrapment	0.77	0.78	0.74	0.70	0.70	0.63
SNI humiliation	0.53	0.50	0.49	0.51	0.52	0.42
SNI perfectionism	0.27	0.25	0.24	0.27	0.28	0.21
SNI GD	-0.13	-0.14	-0.15	-0.10	-0.09	-0.13
SNI GR	0.44	0.45	0.44	0.37	0.39	0.37
SLEs in the past week	0.40	0.37	0.41	0.36	0.39	0.29
SLEs in the past 3 months	0.44	0.39	0.44	0.40	0.43	0.33
Lifetime SI	0.50	0.49	0.47	0.46	0.47	0.42
Past-month SI	0.54	0.56	0.55	0.48	0.48	0.39
Lifetime SA	0.32	0.32	0.32	0.28	0.31	0.25
Mean	92.76	15.03	26.44	20.71	21.89	8.70
SD	59.46	12.24	18.49	13.47	13.26	6.08
Range	0-228	0-40	0-72	0-44	0-52	0-20
Skewness	0.28	0.46	0.46	0.10	0.22	0.23
Kurtosis	-1.07	-1.03	-0.94	-1.25	-1.00	-1.10
Alpha	0.99	0.96	0.95	0.96	0.93	0.92

Point-biserial correlations were performed when examining lifetime and past month suicide attempts, as this variable was dichotomous. All correlations were statistically significant at the  $p < 0.001$  level.

GD = goal disengagement; GR = goal reengagement; PB = perceived burdensomeness; SA = suicide attempt; SCI-2 = Suicide Crisis Inventory-2; SI = suicidal ideation; SLE = stressful life events; SNI = Suicide Narrative Inventory; TB = thwarted belongingness.

In agreement with previous studies, we found that all subscales of the SCI-2 were strongly intercorrelated. These findings further support the notion that the SCI-2 reflects the coherent and cohesive construct of the SCS, characterized by interrelated psychological processes.<sup>20,29</sup> In this context, the SCI-2 is a valid measure of suicidal risk among the Brazilian population.

In addition, we found that the SCI-2 demonstrated strong convergent and criterion validity for the suicidal narrative (except for the goal disengagement subscale), stressful life events, suicidal ideation, and suicide attempts. These findings are consistent with previous studies,<sup>20,23,29,50</sup>

underscoring the importance of the SCI-2 as a valuable indicator of imminent risk for suicidal behavior. Notably, the goal disengagement subscale of the SNI showed a weak and negative correlation with both the total and subscale scores of the SCI-2. These findings are partially consistent with previous studies that also reported weak correlations between the goal orientation factor and suicidal phenomena.<sup>32</sup> Similarly, in an Indian study, the goal reengagement subscale of the SNI alone did not show a strong correlation with any of the SCI-2 subscales.<sup>25</sup> The absence of a positive correlation between the SCI-2 and the goal disengagement scale may indicate that the items in this

subscale are not sensitive to the underlying construct being measured and warrants further investigation.<sup>25,32</sup>

Consistent with the existing literature, our results demonstrate that the Brazilian version of the SCI-2 has excellent internal consistency. These results are consistent with previous studies that have examined the SCI-2 in different cultural contexts, including psychiatric samples from the United States,<sup>23</sup> the general population of India,<sup>25</sup> a sample from South Korea,<sup>27</sup> forensic psychiatric patients from Germany,<sup>51</sup> among others.<sup>20,29</sup>

Finally, four cognitive rigidity items did not load on either the SCI-2 total score or the loss of cognitive control scale. Similarly, recent cross-cultural factor analyses showed that reverse-coded cognitive rigidity items did not load on their respective factors.<sup>25,27,52</sup> However, Bloch-Elkouby et al.<sup>23</sup> showed that SCI-2 items assessing loss of cognitive control had exceptional predictive power (area under the curve above 0.9) for near-term suicide attempts. Consequently, the brevity of the loss of cognitive control subscale was suggested to be a valuable and efficient clinical tool for assessing patient risk.<sup>23</sup> Although the causality of our findings remains uncertain, it is possible that cognitive rigidity may be less central to SCS in our study sample because of cultural factors. Another possible explanation is that impaired decision-making and loss of cognitive control have been associated with individuals who have attempted suicide.<sup>53,54</sup> Since our study was based on a community sample, it is plausible that these individuals have lower levels of cognitive rigidity. We suggest that this finding, in addition to the cross-cultural adaptation of the four items within the loss of cognitive control subscale, be further investigated in future studies in Brazil.

These findings have important implications, as they underscore the validity of the SCI-2 in different cultures, including Brazil. From a clinical standpoint, the SCI-2 can be useful in identifying patients with ambivalence or insufficient awareness of their suicidal tendencies,<sup>20,52</sup> serving as a viable alternative to instruments that overly rely on suicidal ideation to assess suicide risk.<sup>21</sup> Previous studies have demonstrated that the SCI-2 was predictive of suicidal behavior after hospital discharge and had incremental predictive validity over traditional risk factors, such as suicidal ideation and lifetime suicide attempts.<sup>20,23,29,50</sup> Therefore, future research should investigate the validity of the Brazilian version of the SCI-2 in predicting short-term suicidal behavior in high-risk populations compared with traditional risk assessment tools.

This study has some limitations. First, we used an online survey that relies on self-reported data, which may introduce several biases. Furthermore, only people with computer literacy and Internet access could participate. Second, data collection occurred during the COVID-19 pandemic, which may have influenced participants' responses due to the sufferings experienced during this time. Third, the cross-sectional design and retrospective data collection prevent us from drawing conclusions about the predictive validity of the SCI-2 for subsequent suicidal behavior. Fourth, the Brazilian version of the SCI-2 was developed and tested in Brazilian Portuguese. Consequently, its use in other Portuguese-speaking countries

may produce different results. Finally, the data from this study represent a predominantly mixed population, consisting mainly of young, university-educated females. Future research should investigate the validity of the Brazilian version of the SCI-2 in high-risk populations to determine the generalizability of our findings. It is crucial that the SCI-2 and its subscales are effective in different conditions and settings, including both low- and high-risk suicide subgroups. Therefore, the evaluation of Brazilian individuals at risk of suicide would strengthen the conclusions drawn from the Brazilian version of the SCI-2.

Our findings suggest that the five-factor model of the Brazilian version of the SCI-2 serves as a reliable, valid instrument for assessing suicide risk, independent of self-reported suicidal ideation, as demonstrated in a community sample. Furthermore, this study contributes to the growing knowledge of the SCS as a discrete and specific condition related to suicide.

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JQ receives clinical research support from LivaNova; is a member of the speaker bureau with Myriad Neuroscience and AbbVie; is a consultant for EMS, Libbs, and Eurofarma; is a stockholder at Instituto de Neurociencias Dr. Joao Quevedo; and receives royalties from Artmed Editora, Artmed Panamericana, and Elsevier/Academic Press. The other authors report no conflicts of interest.

### Author contributions

JPN: Conceptualization, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing.

MLR: Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

JAR: Conceptualization, Project administration, Software, Visualization.

APD: Methodology, Validation, Writing – review & editing.

LBC: Funding acquisition, Resources, Visualization.

GSK: Methodology, Validation, Writing – review & editing.

JQ: Funding acquisition, Methodology, Resources, Supervision, Validation, Writing – review & editing.

IG: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Validation, Writing – review & editing.

SSV: Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Validation, Supervision, Writing – review & editing.

All authors have read and approved of the final version to be published.

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## References

- 1 McDonald K, Machado DB, Castro-de-Araujo LFS, Kiss L, Palfreyman A, Barreto ML, et al. Tendências do suicídio específico do método no Brasil no período de 2000 a 2017. *Soc Psychiatry Psychiatr Epidemiol.* 2021;56:1779-90.
- 2 Soares FC, Stahnke DN, Levandowski ML. [Trends in suicide rates in Brazil from 2011 to 2020: special focus on the COVID-19 pandemic]. *Tendencia de las tasas de suicidio en Brasil, 2011-2020, con especial atención a la pandemia de COVID-19. Rev Panam Salud Publica.* 2022;46:e212.
- 3 Brasil, Ministério da Saúde. Mortalidade por suicídio e notificações de lesões autoprovocadas no Brasil. *Boletim Epidemiológico Vol. 52 – No 33 [Internet]. 2021 Sep 20 [cited 2024 Mar 05]. www.gov.br/saude/pt-br/centrais-de-conteudo/publicacoes/boletins/epidemiologicos/edicoes/2021/boletim\_epidemiologico\_svs\_33\_final.pdf/view*
- 4 Oquendo MA, Baca-Garcia E. Suicidal behavior disorder as a diagnostic entity in the DSM-5 classification system: advantages outweigh limitations. *World Psychiatry.* 2014;13:128-30.
- 5 Franklin JC, Ribeiro JD, Fox KR, Bentley KH, Kleiman EM, Huang X, et al. Risk factors for suicidal thoughts and behaviors: a meta-analysis of 50 years of research. *Psychol Bull.* 2017;143:187-232.
- 6 Bowers L, Douzenis A, Galeazzi GM, Forghieri M, Tsopeles C, Simpson A, et al. Disruptive and dangerous behaviour by patients on acute psychiatric wards in three European centres. *Soc Psychiatry Psychiatr Epidemiol.* 2005;40:822-8.
- 7 Ribeiro JD, Franklin JC, Fox KR, Bentley KH, Kleiman EM, Chang BP, et al. Self-injurious thoughts and behaviors as risk factors for future suicide ideation, attempts, and death: a meta-analysis of longitudinal studies. *Psychol Med.* 2016;46:225-36.
- 8 Podlogar MC, Rogers ML, Chiurliza B, Hom MA, Tzoneva M, Joiner T. Who are we missing? Nondisclosure in online suicide risk screening questionnaires. *Psychol Assess.* 2016;28:963-74.
- 9 Berman AL. Risk factors proximate to suicide and suicide risk assessment in the context of denied suicide ideation. *Suicide Life Threat Behav.* 2018;48:340-52.
- 10 Jobes DA, Joiner TE. Reflections on suicidal ideation. *Crisis.* 2019;40:227-30.
- 11 Richards JE, Whiteside U, Ludman EJ, Pabiniak C, Kirlin B, Hidalgo R, et al. Understanding why patients may not report suicidal ideation at a health care visit prior to a suicide attempt: a qualitative study. *Psychiatr Serv.* 2019;70:40-5.
- 12 Blanchard M, Farber BA. "It is never okay to talk about suicide": patients' reasons for concealing suicidal ideation in psychotherapy. *Psychother Res.* 2020;30:124-36.
- 13 Joiner TE, Simpson S, Rogers ML, Stanley IH, Galynker II. Whether called acute suicidal affective disturbance or suicide crisis syndrome, a suicide-specific diagnosis would enhance clinical care, increase patient safety, and mitigate clinician liability. *J Psychiatr Pract.* 2018;24:274-78.
- 14 Schuck A, Calati R, Barzilay S, Bloch-Elkouby S, Galynker I. Suicide crisis syndrome: a review of supporting evidence for a new suicide-specific diagnosis. *Behav Sci Law.* 2019;37:223-9.
- 15 Galynker I. *The suicidal crisis: clinical guide to the assessment of imminent suicide risk.* New York, NY: Oxford University Press; 2019.
- 16 McMullen L, Parghi N, Rogers ML, Yao H, Bloch-Elkouby S, Galynker I. The role of suicide ideation in assessing near-term suicide risk: a machine learning approach. *Psychiatry Res.* 2012;304:1141-18.
- 17 Cohen LJ, Ardanal F, Yaseen Z, Galynker I. Suicide crisis syndrome mediates the relationship between long-term risk factors and lifetime suicidal phenomena. *Suicide Life Threat Behav.* 2018;48:613-23.
- 18 Bloch-Elkouby S, Gorman B, Schuck A, Barzilay S, Calati R, Cohen LJ, et al. The suicide crisis syndrome: a network analysis. *J Couns Psychol.* 2020;67:595-607.
- 19 Yaseen Z, Katz C, Johnson MS, Eisenberg D, Cohen LJ, Galynker II. Construct development: The Suicide Trigger Scale (STS-2), a measure of a hypothesized suicide trigger state. *BMC Psychiatry.* 2010;10:110.
- 20 Galynker I, Yaseen ZS, Cohen A, Benhamou O, Hawes M, Briggs J. Prediction of suicidal behavior in high risk psychiatric patients using an assessment of acute suicidal state: the suicide crisis inventory. *Depress Anxiety.* 2017;34:147-58.
- 21 Yaseen ZS, Hawes M, Barzilay S, Galynker I. Predictive validity of proposed diagnostic criteria for the suicide crisis syndrome: an acute presuicidal state. *Suicide Life Threat Behav.* 2019;49:1124-35.
- 22 Bloch-Elkouby S, Gorman B, Lloveras L, Wilkerson T, Schuck A, Barzilay S, et al. How do distal and proximal risk factors combine to predict suicidal ideation and behaviors? A prospective study of the narrative crisis model of suicide. *J Affect Disord.* 2020;277:914-26.
- 23 Bloch-Elkouby S, Barzilay S, Gorman BS, Lawrence OC, Rogers ML, Richards J, et al. The revised suicide crisis inventory (SCI-2): validation and assessment of prospective suicidal outcomes at one month follow-up. *J Affect Disord.* 2012;295:1280-91.
- 24 Parghi N, Chennapragada L, Barzilay S, Newkirk S, Ahmedani B, Lok B, et al. Assessing the predictive ability of the suicide crisis inventory for near-term suicidal behavior using machine learning approaches. *Int J Methods Psychiatr Res.* 2021;30:e1863.
- 25 Menon V, Bafna AR, Rogers ML, Richards J, Galynker I. Factor structure and validity of the revised Suicide Crisis Inventory (SCI-2) among Indian adults. *Asian J Psychiatr.* 2022;73:103119.
- 26 Chistopolskaya KA, Rogers ML, Enikolopov SN, Nikolaev EL, Kravtsova NA, Sadovnichaya VS, et al. Adaptation of the Suicide Crisis Inventory (Sci-2) in a Russian internet sample during the Covid-19 Epidemic. *Suicidology.* 2022;13:88-104.
- 27 Park JY, Rogers ML, Bloch-Elkouby S, Richards JA, Lee S, Galynker I, et al. Factor structure and validation of the revised Suicide Crisis Inventory in a Korean population. *Psychiatry Investig.* 2023;20:162-73.
- 28 Wu CY, Lee MB, Rogers ML, Chan CT, Chen CY, Richards J, et al. A validation study of the Taiwanese Suicide Crisis Inventory Version 2 to detect suicidality in an online population survey. *J Suicidol.* 2022;17:124-33.
- 29 Barzilay S, Assounga K, Veras J, Beaubian C, Bloch-Elkouby S, Galynker I. Assessment of near-term risk for suicide attempts using the suicide crisis inventory. *J Affect Disord.* 2020;276:183-90.
- 30 Rogers ML, McMullen L, Liang Y, Perez N, Richards JA, Akülker G, et al. Cross-national presence and sociodemographic correlates of the suicide crisis syndrome. *J Affect Disord.* 2023;329:1-8.
- 31 Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976).* 2000;25:3186-1.
- 32 Cohen LJ, Gorman B, Briggs J, Jeon ME, Ginsburg T, Galynker I. The Suicidal narrative and its relationship to the Suicide Crisis Syndrome and recent suicidal behavior. *Suicide Life Threat Behav.* 2019;49:413-22.
- 33 Chang SY, Lee MB, Wu CY, Rogers ML, Chan CT, Chen CY, et al. Associations between suicide narrative, psychopathology, and suicidality: an online population survey in Taiwan. *J. Suicidol.* 2022;17:238-47.
- 34 Chistopolskaya KA, Rogers ML, Cao E, Galynker I, Richards J, Enikolopov SN, et al. Adaptation of the suicidal narrative inventory in a Russian sample. *Suicidology.* 2022;13:88-104.
- 35 Cohen LJ, Mokhtar R, Richards J, Hernandez M, Bloch-Elkouby S, Galynker I. The Narrative-Crisis Model of suicide and its prediction of near-term suicide risk. *Suicide Life Threat Behav.* 2022;52:231-43.
- 36 Brugha T, Bebbington P, Tennant C, Hurry J. The list of threatening experiences: a subset of 12 life event categories with considerable long-term contextual threat. *Psychol Med.* 1985;15:189-94.
- 37 Goodman LA, Corcoran C, Turner K, Yuan N, Green BL. Assessing traumatic event exposure: general issues and preliminary findings for the Stressful Life Events Screening Questionnaire. *J Trauma Stress.* 1998;11:521-42.
- 38 Kendler KS, Karkowski LM, Prescott CA. Causal relationship between stressful life events and the onset of major depression. *Am J Psychiatry.* 1999;156:837-41.
- 39 Spurgeon A, Jackson CA, Beach JR. The life events inventory: re-scaling based on an occupational sample. *Occup Med (Lond).* 2001;51:287-93.
- 40 Pompili M, Innamorati M, Szanto K, Di Vittorio C, Conwell Y, Lester D, et al. Life events as precipitants of suicide attempts among first-time suicide attempters, repeaters, and non-attempters. *Psychiatry Res.* 2011;186:300-5.
- 41 Buchman-Schmitt JM, Chu C, Michaels MS, Hames JL, Silva C, Hagan CR, et al. The role of stressful life events preceding death by suicide: evidence from two samples of suicide decedents. *Psychiatry Res.* 2017;256:345-52.
- 42 Posner K, Brown GK, Stanley B, Brent DA, Yershova KV, Oquendo MA, et al. The Columbia-Suicide Severity Rating Scale: initial validity



- and internal consistency findings from three multisite studies with adolescents and adults. *Am J Psychiatry*. 2011;168:1266-77.
- 43 Kaiser HF, Rice J. Little jiffy, mark IV. *Educ Psychol Meas*. 1974;34:1111-7.
- 44 Bartlett MS. The effect of standardization on a Chi-square approximation in factor analysis. *Biometrika*. 1951;38:337-44.
- 45 Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling*. 1999;6:1-55.
- 46 Vandenberg RJ, Lance CE. A review and synthesis of the measurement invariance literature: suggestions, practices, and recommendations for organizational research. *Organ Res Methods*. 2000;3:4-70.
- 47 Rosseel Y. lavaan: an R package for structural equation modeling. *J Stat Softw*. 2012;48:1-36.
- 48 Jorgensen TD, Pornprasertmanit S, Schoemann AM, Rosseel Y, Miller P, Quick C, et al. SemTools: useful tools for structural equation modeling. R package version 0.5-4 [Internet]. 2022 May 10 [cited 2024 Mar 05]. [cran.r-project.org/web/packages/semTools/index.html](https://cran.r-project.org/web/packages/semTools/index.html)
- 49 Revelle W. psych: procedures for personality and psychological research [Internet]. 2024 Jan 18 [cited 2024 Mar 05]. [cran.r-project.org/web/packages/psych/index.html](https://cran.r-project.org/web/packages/psych/index.html)
- 50 Bafna A, Rogers ML, Galynker II. Predictive validity and symptom configuration of proposed diagnostic criteria for the Suicide Crisis Syndrome: a replication study. *J Psychiatr Res*. 2022;156:228-235.
- 51 Otte S, Lutz M, Streb J, Cohen LJ, Galynker I, Dudeck M, et al. Analyzing suicidality in German forensic patients by means of the German version of the suicide crisis inventory (SCI-G). *J Forens Psychiatry Psychol*. 2020;31:731-46.
- 52 Rogers ML, Jeon ME, Zheng S, Richards JA, Joiner TE, Galynker I. Two sides of the same coin? Empirical examination of two proposed characterizations of acute suicidal crises: suicide crisis syndrome and acute suicidal affective disturbance. *J Psychiatr Res*. 2023;162:123-31.
- 53 Jollant F, Lawrence NS, Olie E, O'Daly O, Malafosse A, Courtet P, et al. Decreased activation of lateral orbitofrontal cortex during risky choices under uncertainty is associated with disadvantageous decision-making and suicidal behavior. *Neuroimage*. 2020;51:1275-1281.
- 54 Clark L, Dombrovski AY, Siegle GJ, Butters MA, Shollenberger CL, Sahakian BJ, et al. Impairment in risk-sensitive decision-making in older suicide attempters with depression. *Psychol Aging*. 2011;26:321-30.